FIG. 1

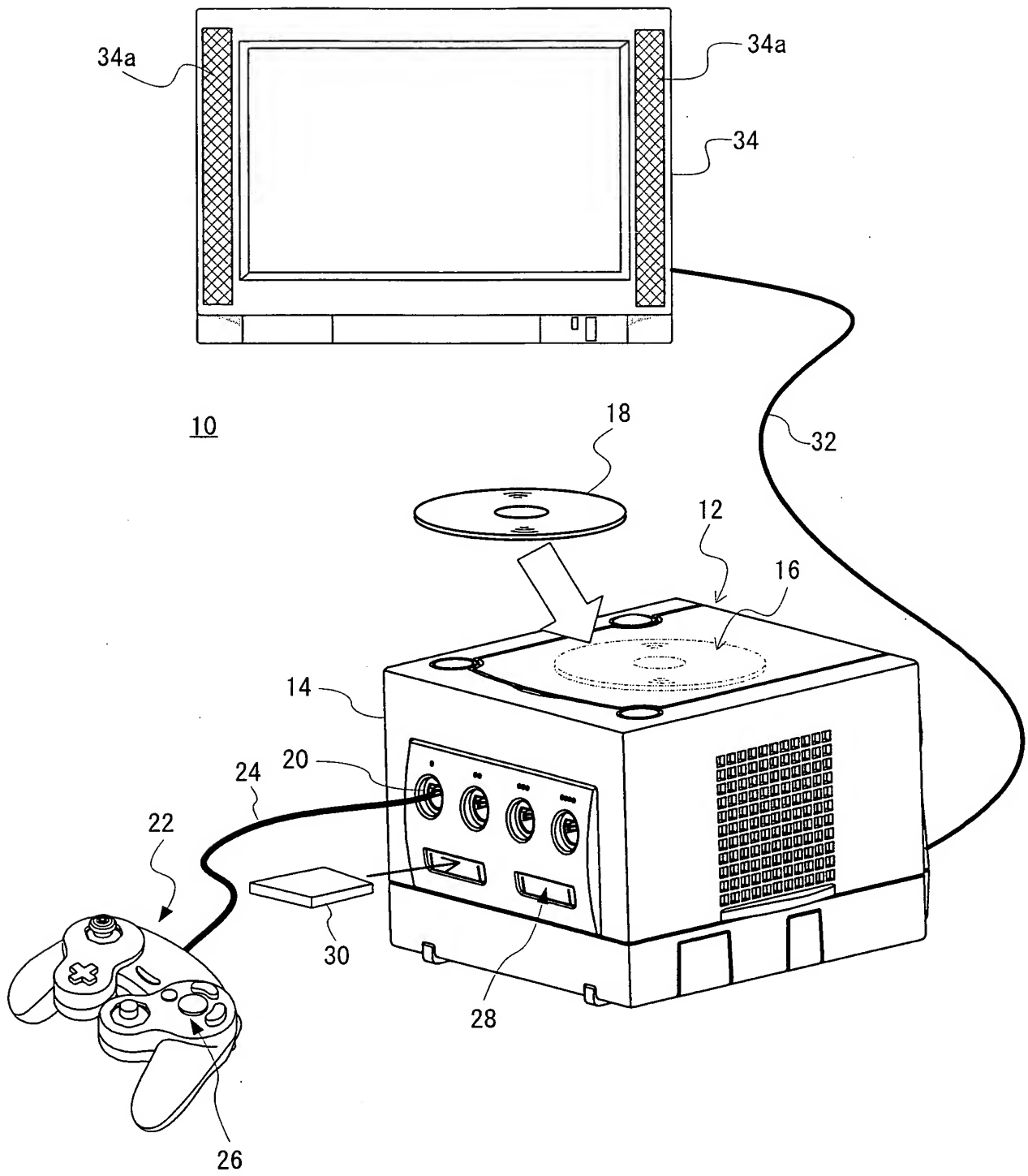


FIG. 2

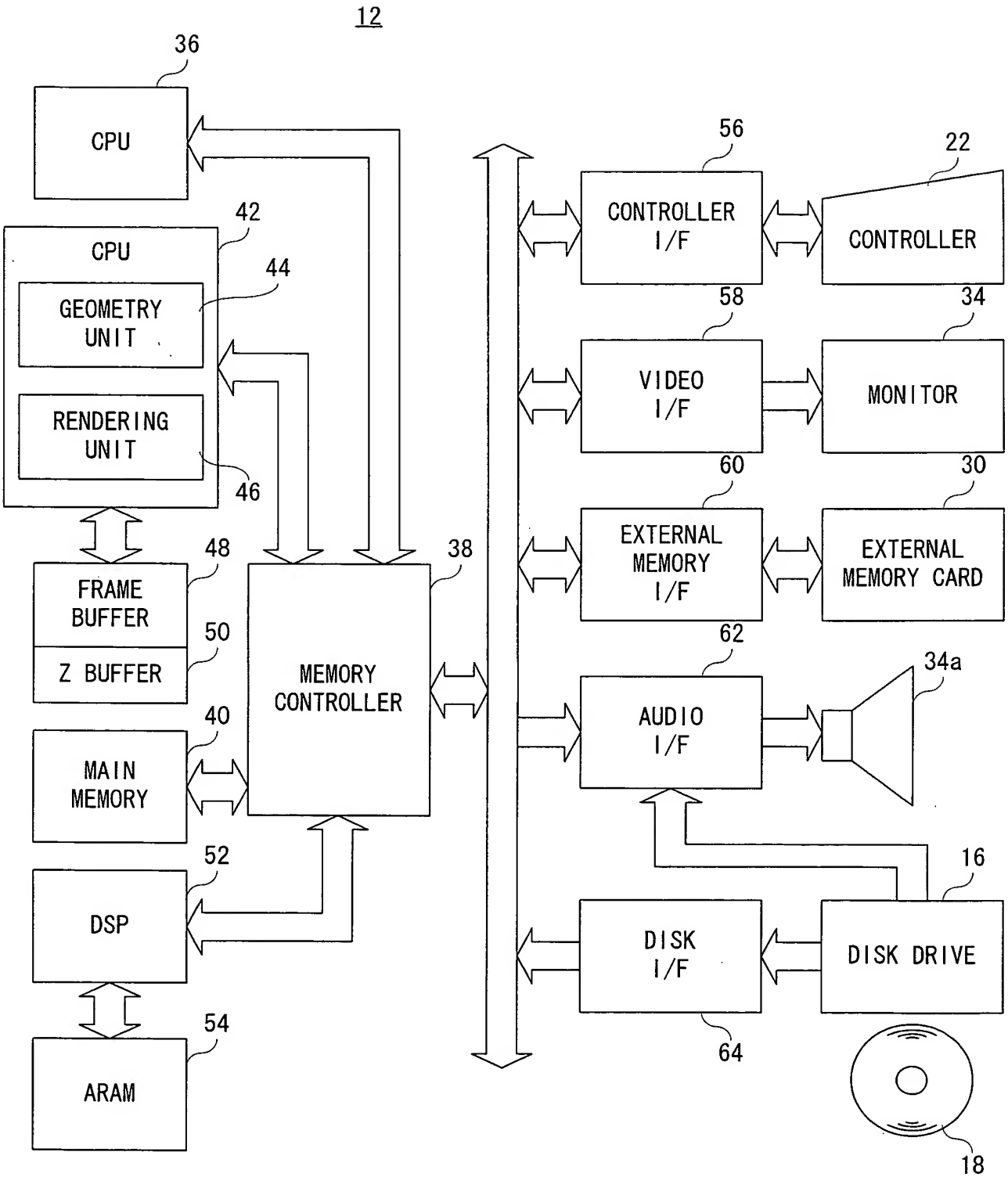

12
36
CPU
42
CPU
44
GEOMETRY UNIT
RENDERING UNIT
46
48
FRAME BUFFER
50
Z BUFFER
38
MEMORY CONTROLLER
40
MAIN MEMORY
52
DSP
54
ARAM
56
CONTROLLER I/F
22
CONTROLLER
58
VIDEO I/F
34
MONITOR
60
EXTERNAL MEMORY I/F
30
EXTERNAL MEMORY CARD
62
AUDIO I/F
34a
16
DISK I/F
DISK DRIVE
64
18

FIG. 3

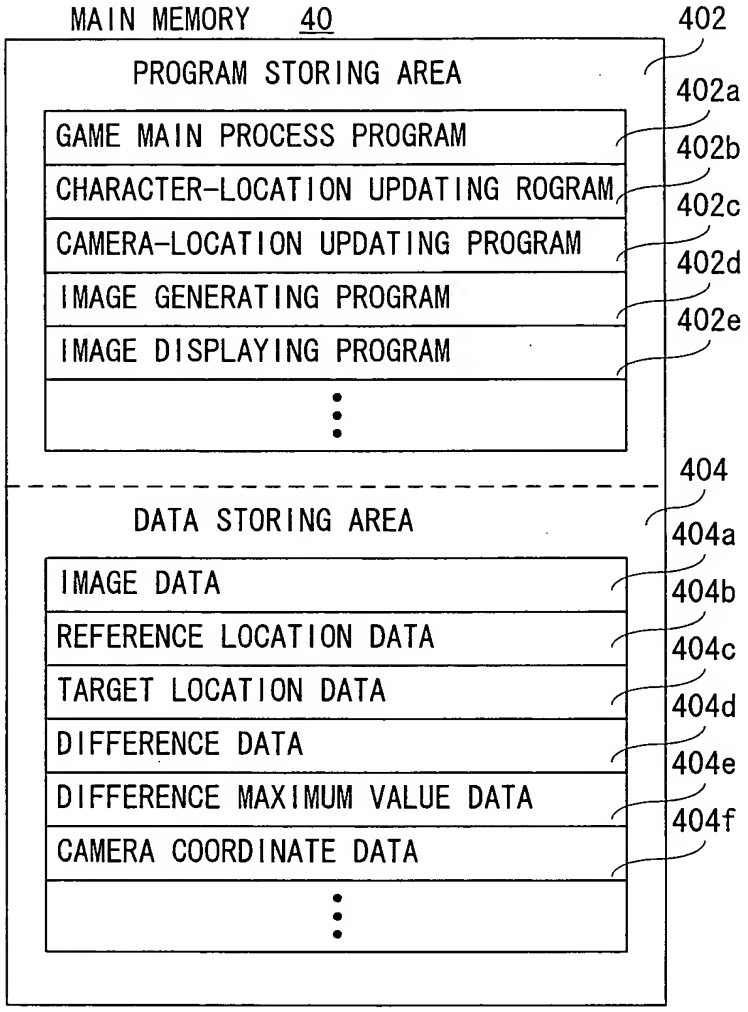

MAIN MEMORY 40
402
PROGRAM STORING AREA
402a
GAME MAIN PROCESS PROGRAM
402b
CHARACTER-LOCATION UPDATING ROGRAM
402c
CAMERA-LOCATION UPDATING PROGRAM
402d
IMAGE GENERATING PROGRAM
402e
IMAGE DISPLAYING PROGRAM
404
DATA STORING AREA
404a
IMAGE DATA
404b
REFERENCE LOCATION DATA
404c
TARGET LOCATION DATA
404d
DIFFERENCE DATA
404e
DIFFERENCE MAXIMUM VALUE DATA
404f
CAMERA COORDINATE DATA

FIG. 4

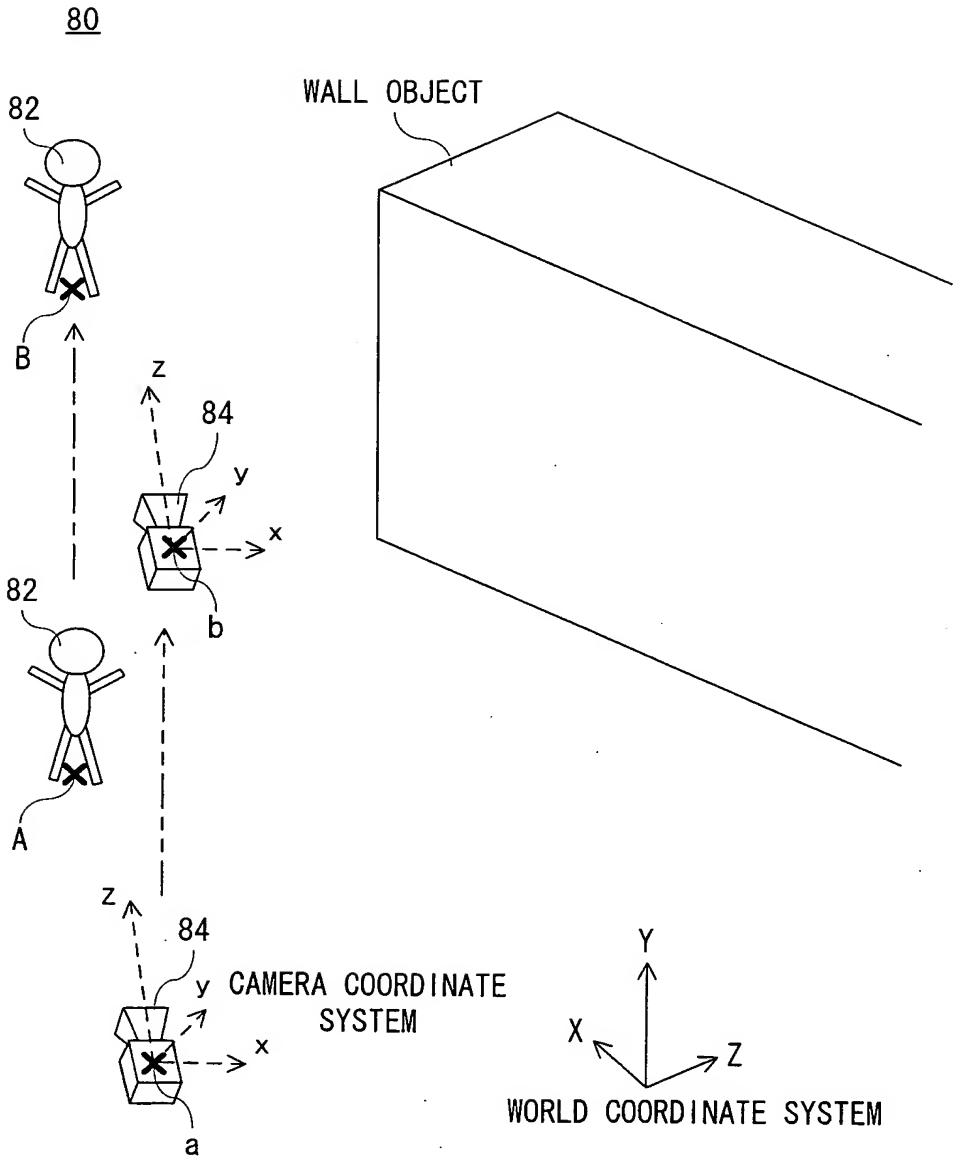

80
WALL OBJECT
82
B
z
84
y
x
b
82
A
z
84
y
x
a
CAMERA COORDINATE SYSTEM
Y
X
Z
WORLD COORDINATE SYSTEM

FIG. 5

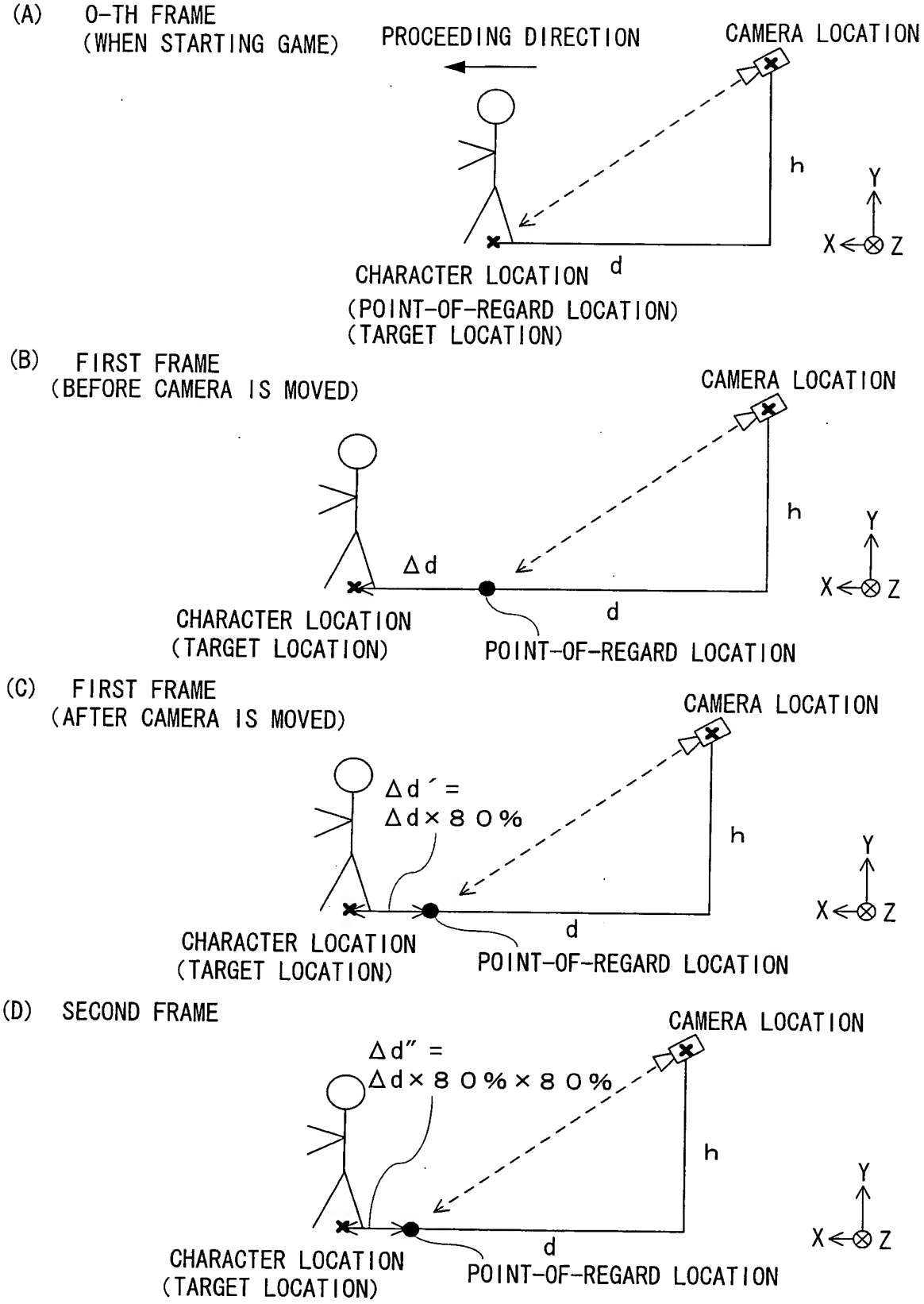

(A) 0-TH FRAME
(WHEN STARTING GAME)
PROCEEDING DIRECTION
CAMERA LOCATION
h
Y
X
Z
CHARACTER LOCATION
d
(POINT-OF-REGARD LOCATION)
(TARGET LOCATION)
(B) FIRST FRAME
(BEFORE CAMERA IS MOVED)
CAMERA LOCATION
h
Δd
Y
X
Z
d
CHARACTER LOCATION
(TARGET LOCATION)
POINT-OF-REGARD LOCATION
(C) FIRST FRAME
(AFTER CAMERA IS MOVED)
CAMERA LOCATION
Δd′ =
Δd×80%
h
Y
X
Z
d
CHARACTER LOCATION
(TARGET LOCATION)
POINT-OF-REGARD LOCATION
(D) SECOND FRAME
CAMERA LOCATION
Δd″ =
Δd×80%×80%
h
Y
X
Z
d
CHARACTER LOCATION
(TARGET LOCATION)
POINT-OF-REGARD LOCATION

FIG. 6

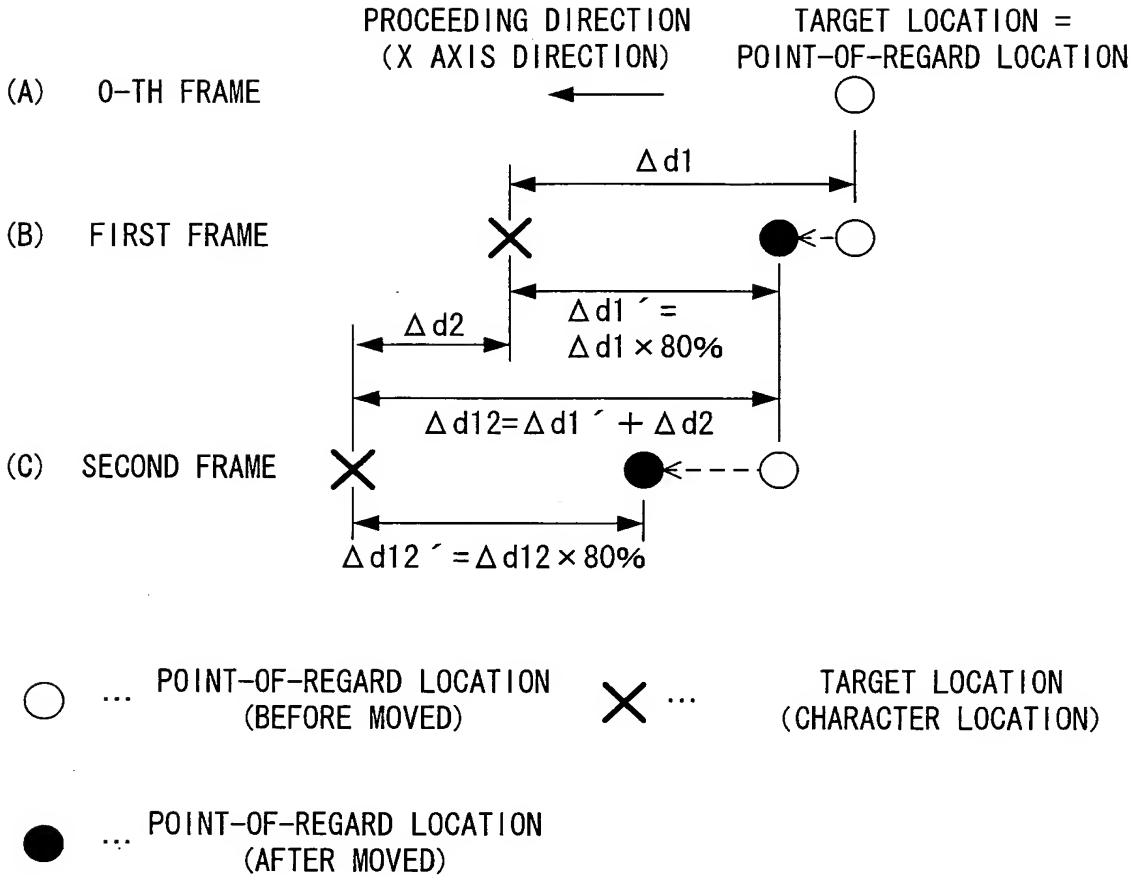

PROCEEDING DIRECTION
(X AXIS DIRECTION)
TARGET LOCATION =
POINT-OF-REGARD LOCATION
(A) 0-TH FRAME
Δd1
(B) FIRST FRAME
Δd2
Δd1´ =
Δd1×80%
Δd12=Δd1´+Δd2
(C) SECOND FRAME
Δd12´=Δd12×80%
... POINT-OF-REGARD LOCATION
(BEFORE MOVED)
... TARGET LOCATION
(CHARACTER LOCATION)
... POINT-OF-REGARD LOCATION
(AFTER MOVED)

FIG. 7

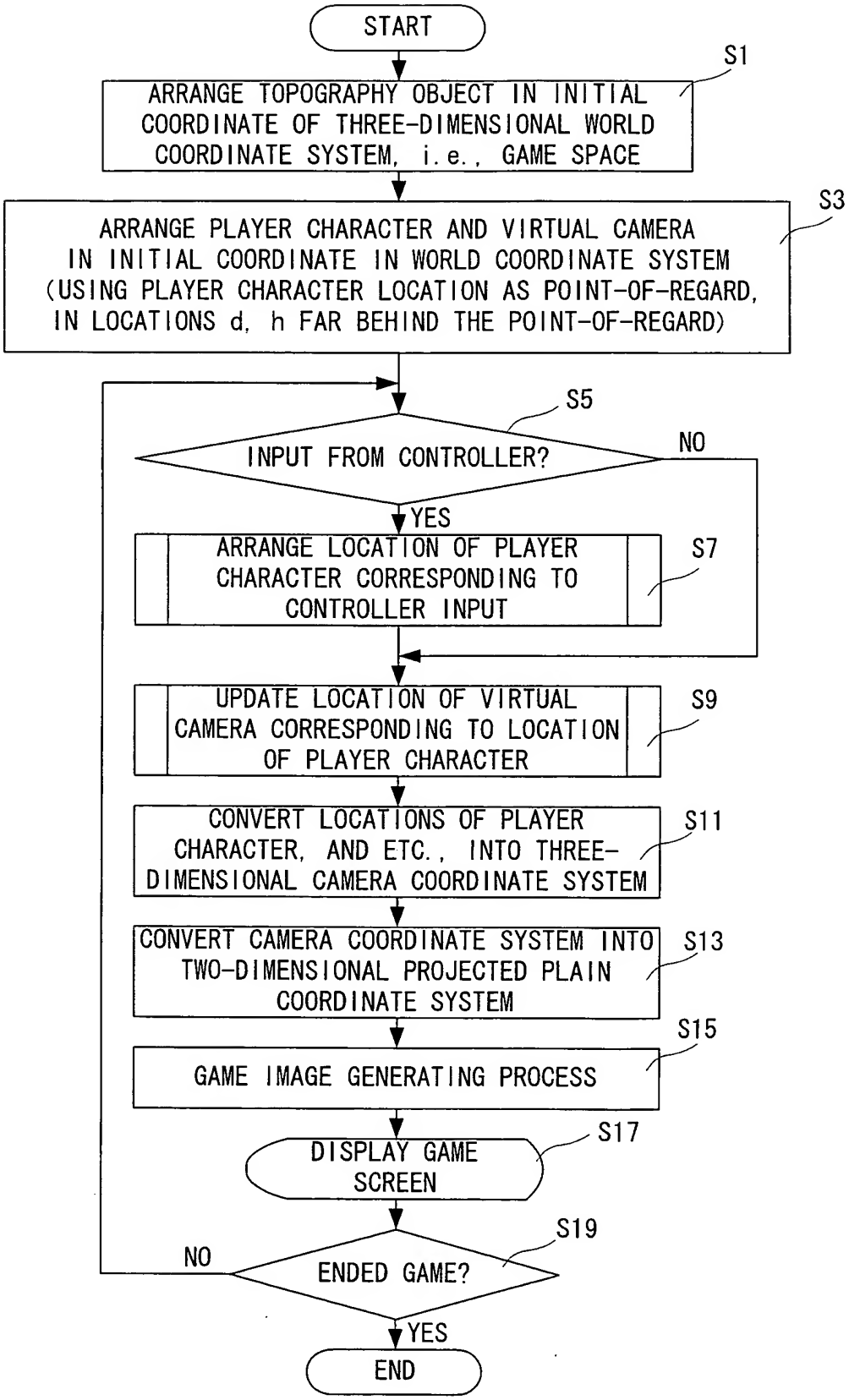

START
S1
ARRANGE TOPOGRAPHY OBJECT IN INITIAL COORDINATE OF THREE-DIMENSIONAL WORLD COORDINATE SYSTEM, i.e., GAME SPACE
S3
ARRANGE PLAYER CHARACTER AND VIRTUAL CAMERA IN INITIAL COORDINATE IN WORLD COORDINATE SYSTEM (USING PLAYER CHARACTER LOCATION AS POINT-OF-REGARD, IN LOCATIONS d, h FAR BEHIND THE POINT-OF-REGARD)
S5
INPUT FROM CONTROLLER?
NO
YES
S7
ARRANGE LOCATION OF PLAYER CHARACTER CORRESPONDING TO CONTROLLER INPUT
S9
UPDATE LOCATION OF VIRTUAL CAMERA CORRESPONDING TO LOCATION OF PLAYER CHARACTER
S11
CONVERT LOCATIONS OF PLAYER CHARACTER, AND ETC., INTO THREE-DIMENSIONAL CAMERA COORDINATE SYSTEM
S13
CONVERT CAMERA COORDINATE SYSTEM INTO TWO-DIMENSIONAL PROJECTED PLAIN COORDINATE SYSTEM
S15
GAME IMAGE GENERATING PROCESS
S17
DISPLAY GAME SCREEN
S19
NO
ENDED GAME?
YES
END

FIG. 8

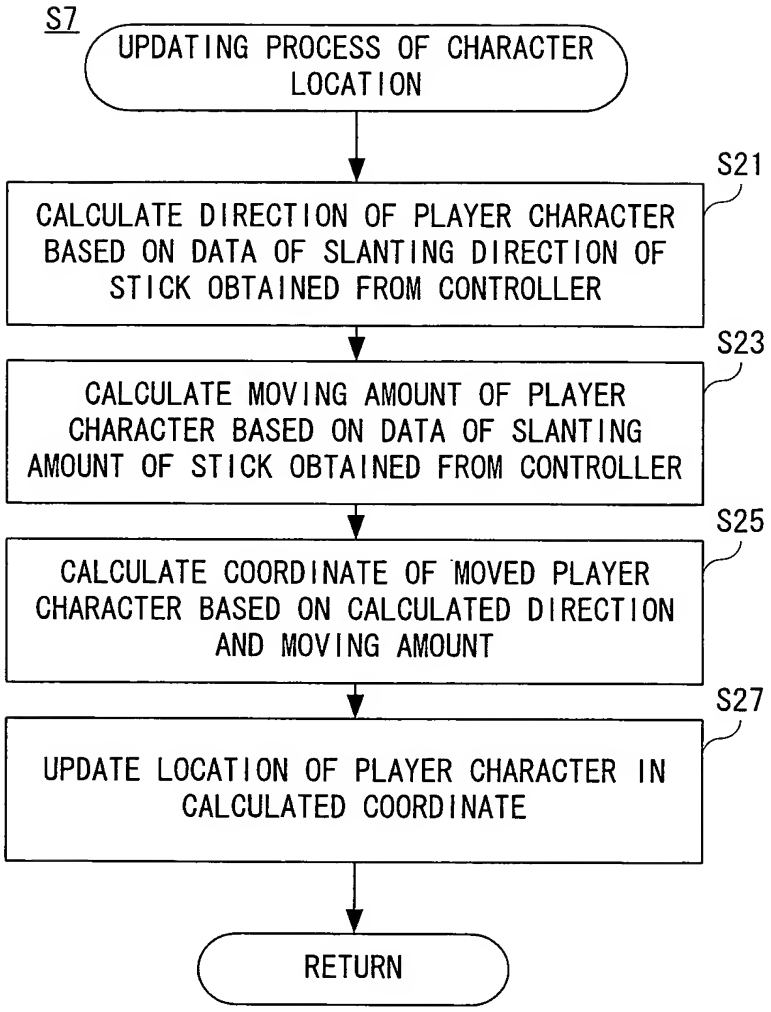

S7
UPDATING PROCESS OF CHARACTER LOCATION
S21
CALCULATE DIRECTION OF PLAYER CHARACTER BASED ON DATA OF SLANTING DIRECTION OF STICK OBTAINED FROM CONTROLLER
S23
CALCULATE MOVING AMOUNT OF PLAYER CHARACTER BASED ON DATA OF SLANTING AMOUNT OF STICK OBTAINED FROM CONTROLLER
S25
CALCULATE COORDINATE OF MOVED PLAYER CHARACTER BASED ON CALCULATED DIRECTION AND MOVING AMOUNT
S27
UPDATE LOCATION OF PLAYER CHARACTER IN CALCULATED COORDINATE
RETURN

FIG. 9

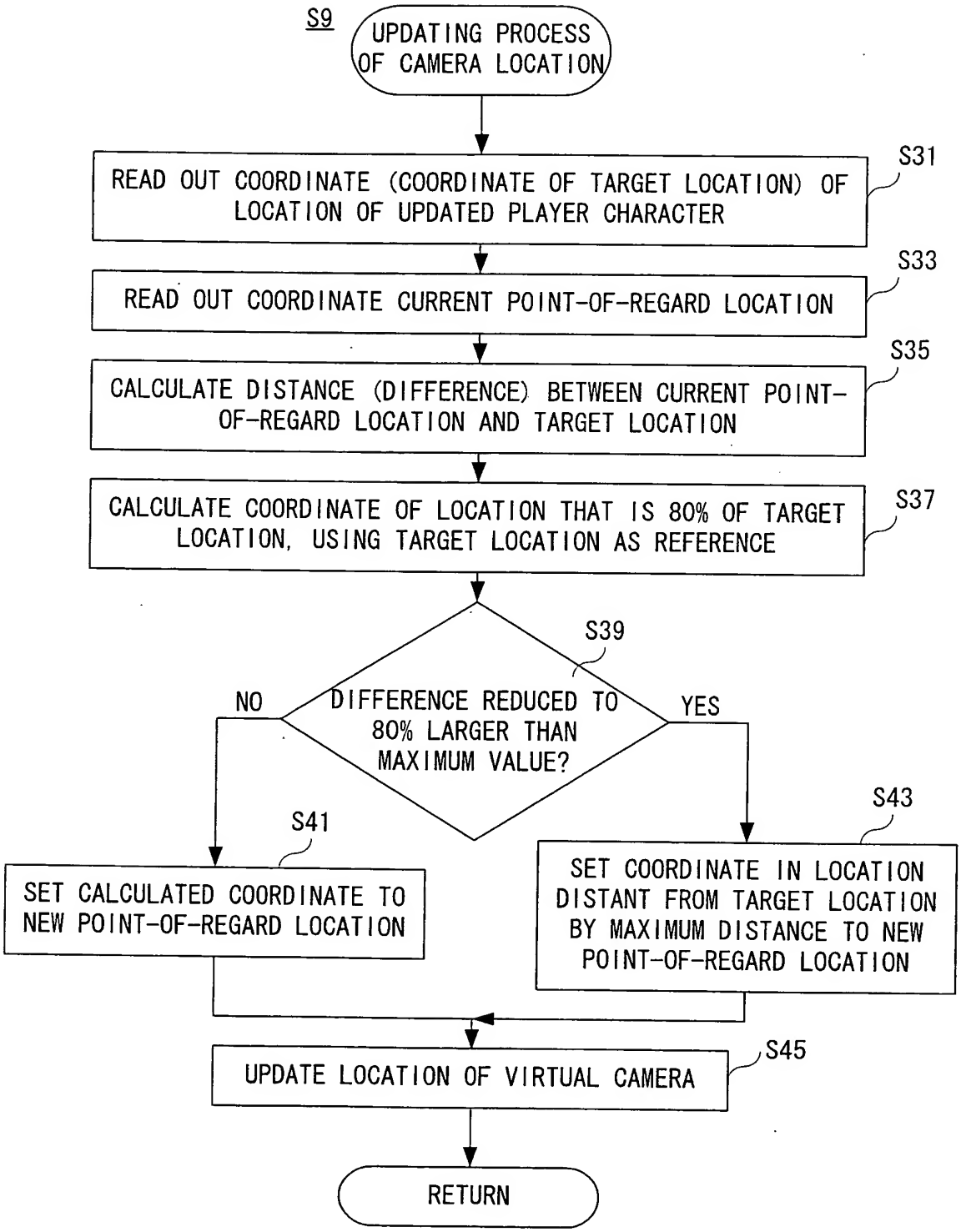

S9
UPDATING PROCESS OF CAMERA LOCATION
READ OUT COORDINATE (COORDINATE OF TARGET LOCATION) OF LOCATION OF UPDATED PLAYER CHARACTER
S31
READ OUT COORDINATE CURRENT POINT-OF-REGARD LOCATION
S33
CALCULATE DISTANCE (DIFFERENCE) BETWEEN CURRENT POINT-OF-REGARD LOCATION AND TARGET LOCATION
S35
CALCULATE COORDINATE OF LOCATION THAT IS 80% OF TARGET LOCATION, USING TARGET LOCATION AS REFERENCE
S37
S39
DIFFERENCE REDUCED TO 80% LARGER THAN MAXIMUM VALUE?
NO
YES
S41
SET CALCULATED COORDINATE TO NEW POINT-OF-REGARD LOCATION
S43
SET COORDINATE IN LOCATION DISTANT FROM TARGET LOCATION BY MAXIMUM DISTANCE TO NEW POINT-OF-REGARD LOCATION
UPDATE LOCATION OF VIRTUAL CAMERA
S45
RETURN

FIG. 10

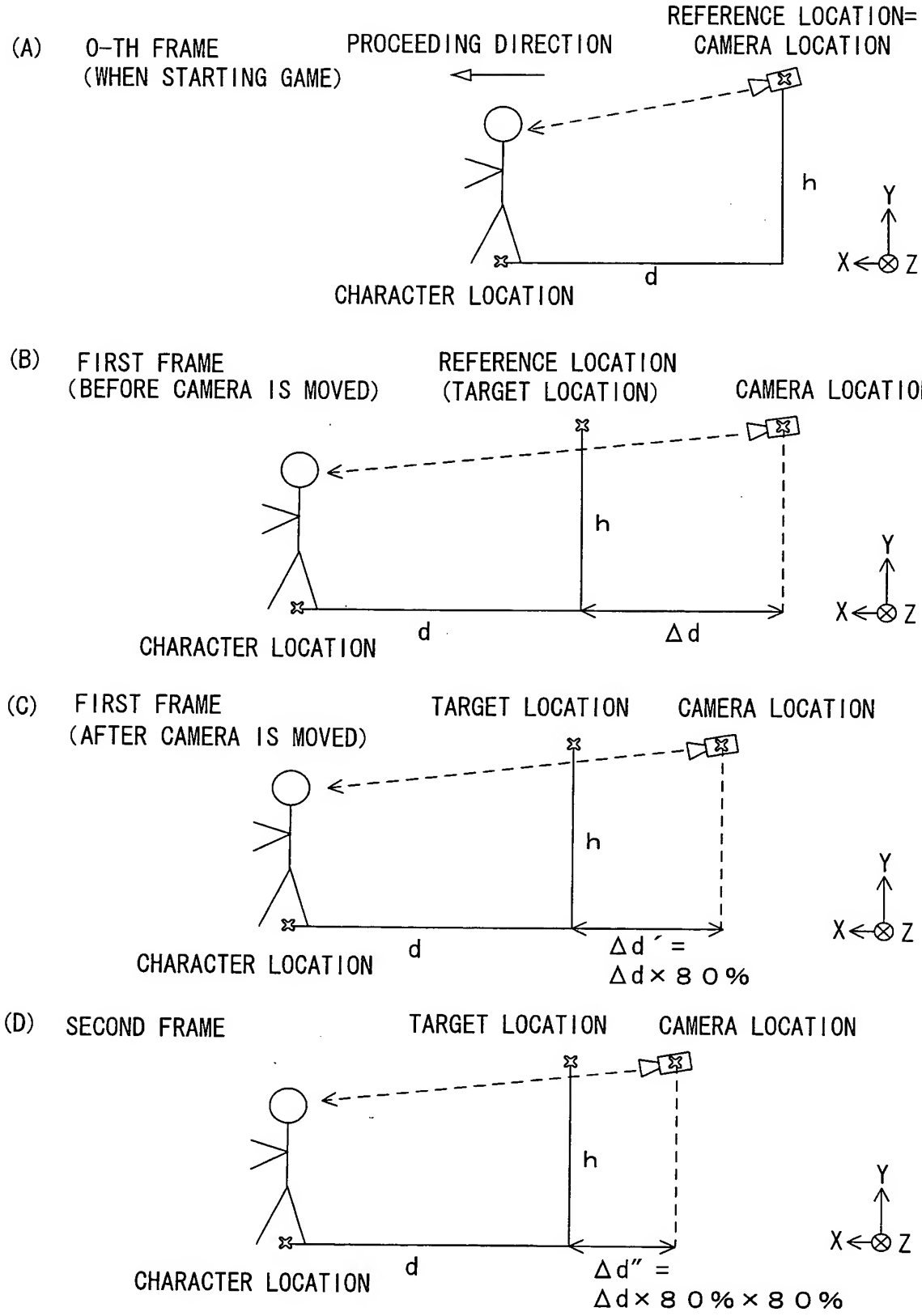
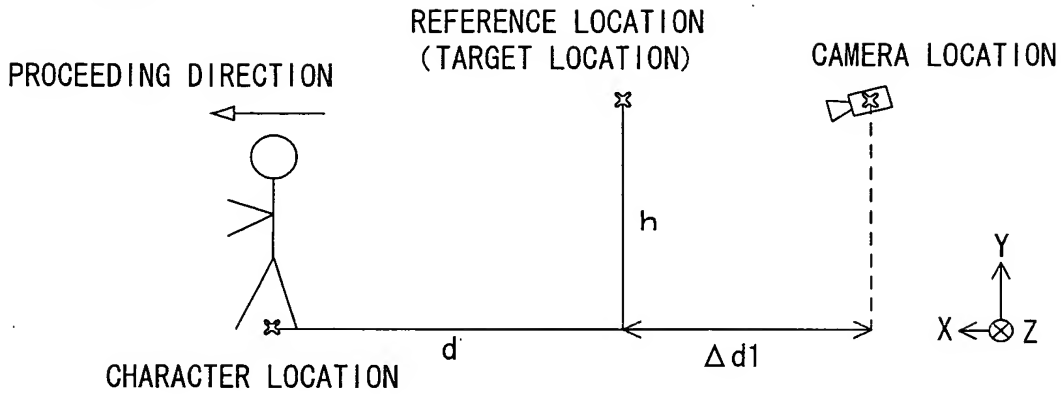
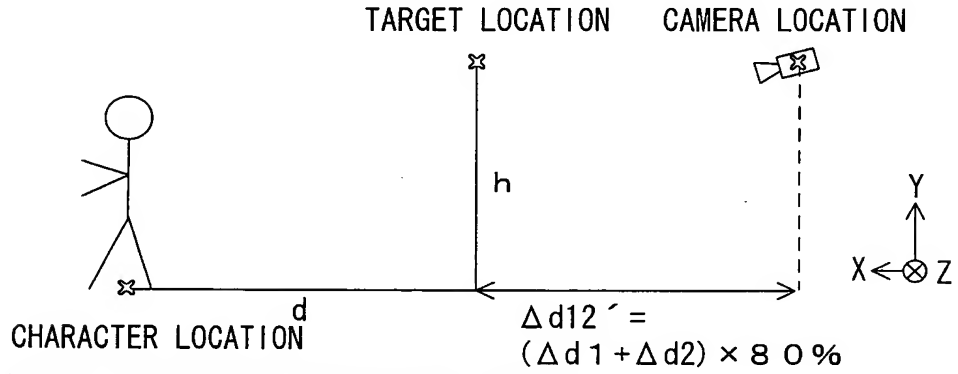

(A) 0-TH FRAME
(WHEN STARTING GAME)
PROCEEDING DIRECTION
REFERENCE LOCATION=
CAMERA LOCATION
h
d
CHARACTER LOCATION
Y
X
Z
(B) FIRST FRAME
(BEFORE CAMERA IS MOVED)
REFERENCE LOCATION
(TARGET LOCATION)
CAMERA LOCATION
h
d
Δd
CHARACTER LOCATION
Y
X
Z
(C) FIRST FRAME
(AFTER CAMERA IS MOVED)
TARGET LOCATION
CAMERA LOCATION
h
d
Δd´=
Δd×80%
CHARACTER LOCATION
Y
X
Z
(D) SECOND FRAME
TARGET LOCATION
CAMERA LOCATION
h
d
Δd″=
Δd×80%×80%
CHARACTER LOCATION
Y
X
Z

FIG. 11

(A) n-th FRAME

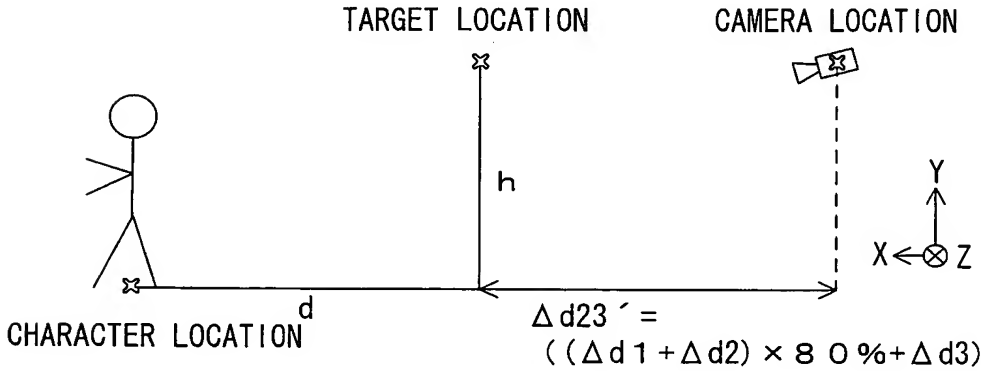


(B) (n+1)-th FRAME



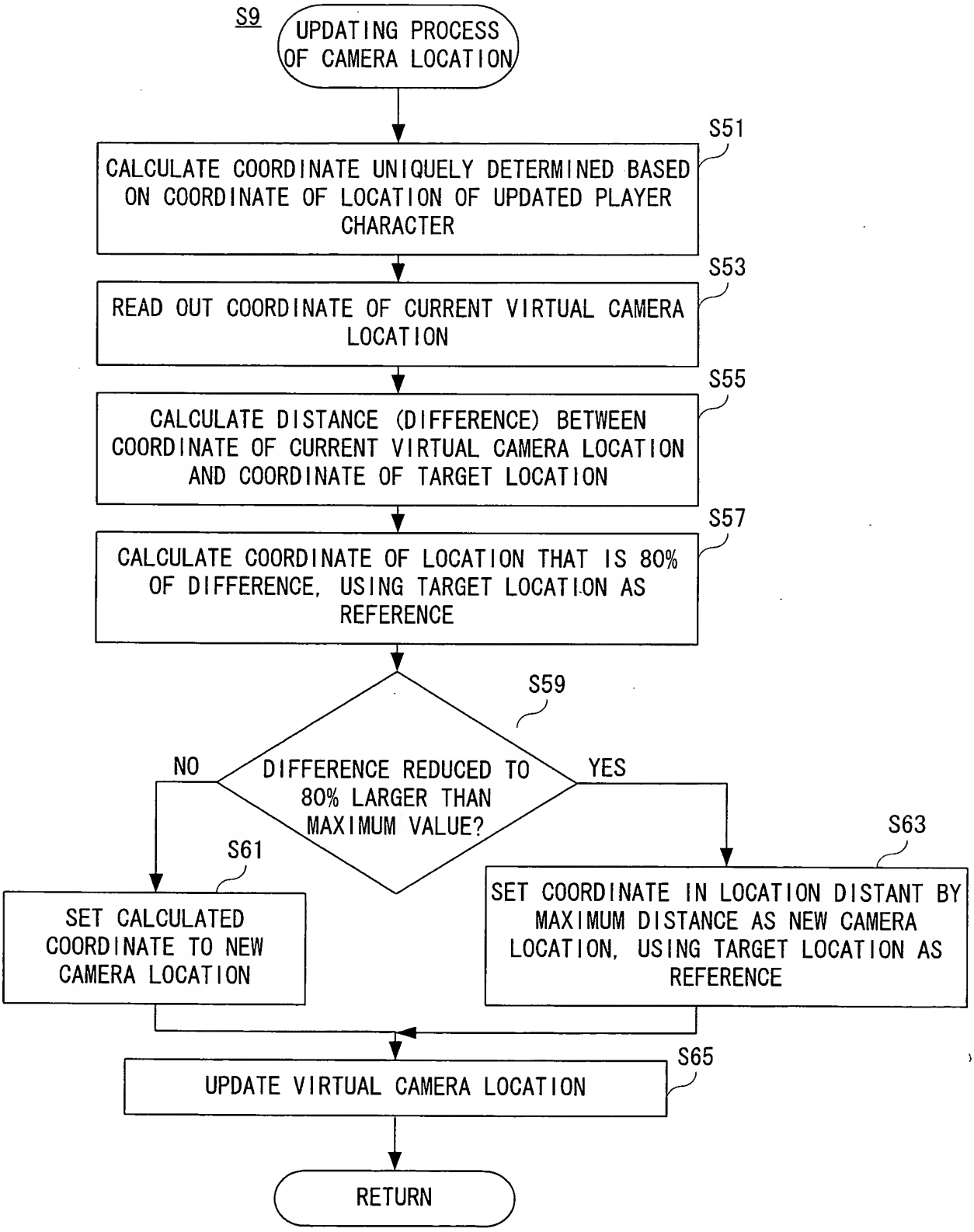
(MOVE Δd2 FROM PRECEDING FRAME)

(C) (n+2)-th FRAME



(MOVE Δd3 FROM PRECEDING FRAME)

FIG. 12


S9
UPDATING PROCESS OF CAMERA LOCATION
S51
CALCULATE COORDINATE UNIQUELY DETERMINED BASED ON COORDINATE OF LOCATION OF UPDATED PLAYER CHARACTER
S53
READ OUT COORDINATE OF CURRENT VIRTUAL CAMERA LOCATION
S55
CALCULATE DISTANCE (DIFFERENCE) BETWEEN COORDINATE OF CURRENT VIRTUAL CAMERA LOCATION AND COORDINATE OF TARGET LOCATION
S57
CALCULATE COORDINATE OF LOCATION THAT IS 80% OF DIFFERENCE, USING TARGET LOCATION AS REFERENCE
S59
DIFFERENCE REDUCED TO 80% LARGER THAN MAXIMUM VALUE?
NO
YES
S61
SET CALCULATED COORDINATE TO NEW CAMERA LOCATION
S63
SET COORDINATE IN LOCATION DISTANT BY MAXIMUM DISTANCE AS NEW CAMERA LOCATION, USING TARGET LOCATION AS REFERENCE
S65
UPDATE VIRTUAL CAMERA LOCATION
RETURN